

10-4 Common Logs

$$\log_{10} x \longleftrightarrow \log x$$

Base of 10

The common logs are used in:

- the richter scale
- pH levels
- decibals of sound

Solve

$$\log_{10} x = 1.65$$

$$\log y = 1.34$$

$$\log z = 1.08$$

$$\begin{aligned} 10^{1.65} &= x \\ 44.7 &= x \\ 10^{1.34} &= y \\ 21.9 &= y \end{aligned}$$

$$12.0 = z$$

Calculator

$$\log 45 \approx 1.65$$

$$\log 22 \approx 1.34$$

$$\log 12 \approx 1.08$$

Solving Exponential Equations

ex

$$3^x = 27$$

$$3^x = 3^3$$

$$x = 3$$

Solving Exponential Equations

ex

$$3^{2x} = 5$$

$$\log 3^{2x} = \log 5$$

$$2x \cdot \log 3 = \log 5$$

$$2 \log 3$$

$$x = \frac{\log(5)}{(2 \log 3)}$$

$$x = .7325$$

ex

$$2^x = 7$$

$$\log 2^x = \log 7$$

$$x \log 2 = \log 7$$

$$x = \frac{\log 7}{\log 2}$$

$$x = 2.8074$$

ex:

$$\frac{1}{2}^x \geq 6$$

$$\log \frac{1}{2}^x \geq \log 6$$

$$x \log \frac{1}{2} \geq \log 6$$

$$\log \frac{1}{2}$$

$$x \leq -2.5850$$

We're
÷ by a
negative
so we switch
to ≤

ex:

$$42^{x-1} = 17^{3x-1}$$

$$(x-1) \log 42 = (3x-1) \log 17$$

$$x \log 42 - \log 42 = 3x \log 17 - \log 17$$

$$x \log 42 - 3x \log 17 = \log 42 - \log 17$$

$$x(\log 42 - 3 \log 17) = \log 42 - \log 17$$

$$x = \frac{(\log 42 - \log 17)}{(\log 42 - 3 \log 17)}$$

ex:

$$8^{2x-1} = 39^{x+1}$$

$$(2x-1) \log 8 = (x+1) \log 39$$

$$2x-1 = (x+1) \frac{\log 39}{\log 8}$$

$$2x-1 = (x+1) 1.7618$$

$$2x-1 = 1.7618x + 1.7618$$

$$.2382x = 2.7618$$

$$x \approx 11.5945$$

ex

Evaluate

$$\log_2 9 = \frac{\log 9}{\log 2}$$

$$\log_4 12 = \frac{\log 12}{\log 4}$$

$$2^y = 9$$

$$y \log 2 = \log 9$$

$$y = \frac{\log 9}{\log 2}$$

Cannot do on calc because base of 2

Change of Base Formula

$$\log_a n = \frac{\log_b n}{\log_b a}$$

$n > 0$
 $a > 0$
 $b > 0$
 $b \neq 1$
 $a \neq 1$

ex

$$\log_4 7 = \frac{\log 7}{\log 4} \approx 1.4037$$

ex

$$\log_3 5$$

Do:

1. $\log_7 12$

2. $\log_5 3$

3. $2^{3x} = 7$

Show

$$\log_{25} 2 = \frac{\log_5 2}{2}$$

p550

27-~~49~~ odd~~41~~ + 45